FORM PTO-1390 REV. 2/01 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 08379.0002

U.S. APPLICATION NO. (If known, see 37CFR1.5): 09/807510

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/IT00/00318	July 27, 2000	August 19, 1999

TITLE OF INVENTION: ANTI-DEFLAGRATING OPERATING ACTUATOR

APPLICANT(S) FOR DO/EO/US: Bernardino DE MARTINO

Applicant(s) herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c)(2)).
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed with the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154 (d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)).
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A Substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154 (d)(4).
19. ☐ A second copy of the English language translation of the international application 35 U.S.C. 154 (d)(4).
20. ☒ Other items or information:
   a. ☒ Copy of cover page of International Publication No. WO01/15303 A1.
   b. ☐ Copy of Notification of Missing Requirements.
   c. ☐

JC02 Rec'd PCT/PTO 16 APR 2001

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/807510	INTERNATIONAL APPLICATION NO. PCT/IT00/00318	ATTORNEY'S DOCKET NUMBER 08379.0002

21. ☒ The following fees are submitted:

					CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO .... **$1000.00** International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO .... **$860.00** International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search fee (37 CFR 1.445(a)(2)) paid to USPTO .... **$710.00** International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) .... **$690.00** International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33 (1)-(4) **$100.00**						
ENTER APPROPRIATE BASIC FEE AMOUNT =					$860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).					$	
CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE		
Total Claims	11	- 20 =		x $18.00	$	
Independent Claims	1	-3 =		x $80.00	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+$270.00	$	
TOTAL OF THE ABOVE CALCULATIONS =					$860.00	
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.					$430.00	
SUBTOTAL =					$430.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest priority date (37 CFR 1.492(f)).					$	
TOTAL NATIONAL FEE =					430.00	
Fee for recording the enclosed assignment (37 CFR 1.21 (h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property. +					$40.00	
TOTAL FEES ENCLOSED =					$470.00	
					Amount to be refunded:	$
					charged:	$

a. ☒ A check in the amount of $ 470.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ______ in the amount of $ ______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 06-0916. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING**: Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P
1300 I Street, N.W.
Washington, D.C. 20005-3315

SIGNATURE

Ernest F. Chapman, Reg. No. 25,961
NAME/REGISTRATION NO.

DATED: April 16, 2001

2/PRTS

09700751U
JC02 Rec'd PCT/PTO 16 APR 2001
PCT/IT00/00318

ANTI-DEFLAGRATING OPERATING ACTUATOR

The present invention refers to an actuator adapted to operate in environments with explosive atmosphere that is present in such an amount as to require special precautions when using electric, pneumatic or mechanical apparata.

An actuator in an environment with explosion risks must be able to withstand, according to the degree of risk associated with the type of atmosphere in which the actuator itself operates, the explosion force that is characteristic for any given gas or mixture.

According to the known prior art, there are several deflagration-protecting procedures for an actuator, each one of which being aimed to insulate the components that are prone to explode. In the specific case to which the present invention refers, the protection from deflagration is guaranteed by encapsulating the critical actuator parts into a suitable vessel equipped with outlets both for the connection of mechanical parts

transmitting the mechanical power and for the electric supply and control connections.

The geometric shape of the vessel, the volume ratio occupied by the components with respect to the internal volume of the housing containing them and the degree of uniformity of the free volume, are some of the design variables whose optimisation affects both the static response and the dynamic response of the actuator to an explosion. With respect to a possible detonation phenomenon, it is good practice to keep the free volume uniform inside the vessel, thereby avoiding the occurrence of precompression phenomena with following detonation. In the majority of times, a device results that is scarcely appreciated due to excessive overall dimensions with problems in placing it above all where the available space is reduced.

Object of the present invention is solving the above prior-art problems by providing an anti-deflagrating operating actuator, adapted to operate in an enviroment that is classified - according to the standards currently in force - as having the maximum explosion risk, such actuator providing the following features:

- both the components subjected to electric voltage, and the gear reducer, and the motion transmitting mechanism and/or the mechanism transforming the motion from rotary to linear one - in case of an actuator whose output motion is of the linear type - are integrally protected against deflagration;
- the external housing optimally coats the apparata contained therein, reproducing the outline of the contained parts, guaranteeing final reduced volume and weight, and keeping the free volume thereinto uniform, guaranteeing a reduced or even absent detonating effect;
- the outlets connecting the mechanical parts transmitting the mechanical power are ergonomically placed, guaranteeing an easy actuator installation next to walls;
- the outlets conecting electric supply and control connections are placed in such a way as not to interfere with the wiring resistance, thereby avoiding its kinking and the following stretching thereof;
- in case of an angular-operating actuator, the

motion transmission is direct, and is obtained through an intermediate connection shaft from the reducer shaft contained into the housing, to the user placed outside.

The above and other objects and advantages of the invention, as will appear from the following description, are obtained by an actuator as claimed in Claim 1. Preferred embodiments and non-trivial variations of the present invention are claimed in the dependent Claims.

The present invention will be better described by some preferred embodiments thereof, given as a non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 is a schematic side view of an anti-deflagrating operating actuator of the angularly operating type; and
- Figure 2 is a schematic side view of an anti-deflagrating operating actuator of the linearly operating type.

The angularly operating actuator of Fig. 1 is substantially composed of an half-shell 1 whose cylindrical mantle 2, that is smooth and free from interruptions, is equipped at both ends thereof with an internal threading section 2a and 2b with

an adequate length.

The opposite end of the cylindrical mantle 2 is closed through a plug 3 with a suitable thickness (s3) that is able to withstand, without distortions, the deflagration-induced force or anyway the design pressure to which the actuator is subjected; an hole or the holes that are necessary for the outside connection of the electric wiring 20, or the related connection, is/are possibly obtained on such plug 3. Next to the threaded coupling, a sealing ring 4 is placed. In a further embodiment of the actuator, the cylindrical mantle 2 is integral with the plug 3. In both cases, they are made of an aluminium alloy melt for shell casts.

An upper half-shell 5, made of an aluminium alloy melt for shell casts, is coupled with the half-shell 1 through a threaded flange 6, having an external threading 6a. This flange 6 operates as a support for the servomotor SM body.

The upper half-shell 5 is equipped with a threaded through-hole that is made of a plane section of the side surface and is coupled with a very thick cylindrical sleeve 40 through the threaded end. Next to the threaded coupling, a

sealing ring is placed.

This sleeve 40 is connected to a pin 8 made of stainless steel, such pin 8 transmitting the twisting torque, through the rolling bearings 9 arranged at the two ends of sleeve 40; these bearings 9 are placed with suitable coupling tolerances and are secured through resilient rings 12. The bearings 9, in addition to ensuring the axial centering of the stainless steel pin 8, are able to withstand the possible loads to which such pin 8 is subjected. At least two rings 13, inserted onto the pin 8, are sandwiched between pin 8 and sleeve 40.

The pin 8 is the outlet axis, being equipped with a seat shaped as a prism, and is adapted to transfer the twisting torque by means of the prism-shaped seat 11, integral to the servomotor SM, and perfectly matching the above-described prism-shaped groove.

The servomotor SM is projectingly secured to the threaded flange 6, this latter one being equipped with a suitable groove for sliding the servomotor body when assembling, by aligning its own outlet axis with the transmission axis through threaded fixings; two further brackets 14, integral

with the flange 6, allow stiffening the coupling between servomotor SM and housing, through suitable holes obtained at the end of each bracket 14 to secure the threaded pins 16 that are integral with the servomotor.

The fact of having made the servomotor SM integral with the flange 6 allows facilitating the assembling operation with the above-described half-shell 1. In fact, once having assembled the servomotor SM to the respective flange 6, both half-shell 1 and plug 3 are screwed; and after that, as last operation, the electric connection cable is secured through the cable-pressing device 21, this latter one being equipped with a suitable anti-deflagrating operating securing ring nut. The electric cable section 22 that connects the actuator at least till the first shunting box SD is contained into a suitable metallic tear-preventing sheath coated with PVC and with a mechanical seal.

The housing coats the servomotor placed inside it by employing a thickness increase next to the brackets 14 or by adding a volume of suitably dense material 23 where the housing volume that has remained free, particularly in the half-shell 1, is non-uniform with respect to the remaining volume,

above the threshold over which uncontrolled detonation phenomena can occur. It is clear that by adding the volume of material 23, it is possible to monitor the detonation by optimising the dynamic actuator response to deflagrations.

The linearly operating actuator of Fig. 2 is equipped with a box ST transforming the motion from rotary to linear one. This box ST is contained within the housing of the above-described type, being integral with the servomotor SM body.

A very thick cylindrical sleeve 50 is coupled with the flange 43 through the threaded end. This sleeve 50 is connected to a pin 44 made of stainless steel, equipped with a linear translation motion and going out of the motion-transforming box ST through the sliding bearings 45 arranged along the sleeve 50.

Both the final volume and the final weight of the angularly and linearly operating actuators are optimised; the outlets for connecting mechanical parts that transmit the mechanical power are placed in ergonomic positions, guaranteeing an easy actuator installation next to the walls; the outlets for connecting the electric supply and control connections are placed in order not to

impair the wiring efficiency, avoiding the kinking and following stretching thereof; in case of the angularly operating actuator, the angular motion transmission is direct, being obtained through an intermediate connection shaft from the reducer shaft, contained inside the housing, to an external user.

A simplified actuator is thereby obtained as regards the number of transmission components, having done without the use of intermediate linear motion transmissions such as the rack, this latter one being widely used in the prior art.

A further novelty obtained by the actuator of the present invention is that the two threaded couplings 2a-6a and 2b-3b between cylindrical mantle 2 and, respectively, flange 6 and circular plug 3, are realised through a left-handed threading SN and a right-handed threading DS, respectively. With such arrangement, it is possible to assemble the two half-shells 1 and 5 by simply rotating the cylindrical mantle 2 with respect to the plug 3 and the flange 6 with the advantage of removing the risk of kinking and stretching the electric wiring. In such a way, the assembly can strictly comply with a simplified procedure divided

into several mechanical and automatic steps, having done without the subjective handling intervention with unidirectional threaded elements.

An assembly of this type is available to be used in line with simple rotation steps of the cylindrical trunk and the only translation of the two plugs.

In a further variation of the invention, the brackets 14 that slide and supprt the motor are integrally obtained with the flange 6 through melting in an aluminium alloy shell for casts.

CLAIMS

1. Anti-deflagrating operating actuator, adapted to operate in an environment with explosion risks, characterised in that both components that are subjected to electric voltage, and a gear reducer, and a motion transmission mechanism and/or a mechanism transforming rotary motion into linear motion, are integrally protected against deflagration.
2. Anti-deflagrating operating actuator according to Claim 1, characterised in that an external protection housing optimally coats apparata contained into the actuator, perfectly reproducing an outline of all parts contained into the actuator.
3. Anti-deflagrating operating actuator according to Claim 2, characterised in that a free volume inside the protection housing is kept uniform.
4. Anti-deflagrating operating actuator according to Claim 1, characterised in that outlets for connecting mechanical parts that transmit mechanical power are placed in ergonomic positions with reduced encumbrance.
5. Anti-deflagrating operating actuator according

to Claim 1, characterised in that outlets for connecting electric supply and control connections are placed in order not to impair wiring resistance, avoiding to kink and consequently to stretch the wiring.

6. Anti-deflagrating operating actuator according to Claim 1, characterised in that an angular motion transmission is direct.

7. Anti-deflagrating operating actuator according to Claim 5, characterised in that an electric connection cable is secured to the housing through a cable-pressing device (21) equipped with a suitable securing and anti-deflagrating operating ring nut.

8. Anti-deflagrating operating actuator according to Claim 5, characterised in that a section of the electric cable that connects the actuator at least up to a first shunting box is contained in a suitable metallic tear-preventing sheath, reinforced with PCT and with a mechanical seal.

9. Anti-deflagrating operating actuator according to Claim 3, characterised in that a housing volume remained free is made uniform by increasing a thickness next to brackets (14) supporting a servomotor (SM) or by filling the

housing volume with adequately dense material.

10. Anti-deflagrating operating actuator according to Claim 1, characterised in that two threaded couplings (2a-6a, 2b-3b) between a cylindrical mantle (2) and respective flanges (6) are realised respectively through a left-handed threading (SN) and a right-handed threading (DS).

11. Anti-deflagrating operating actuator according to Claim 1, characterised in that brackets (14) supporting a servomotor (SM) are integrally obtained with a flange (6) through melting in an aluminium alloy shell for casts.

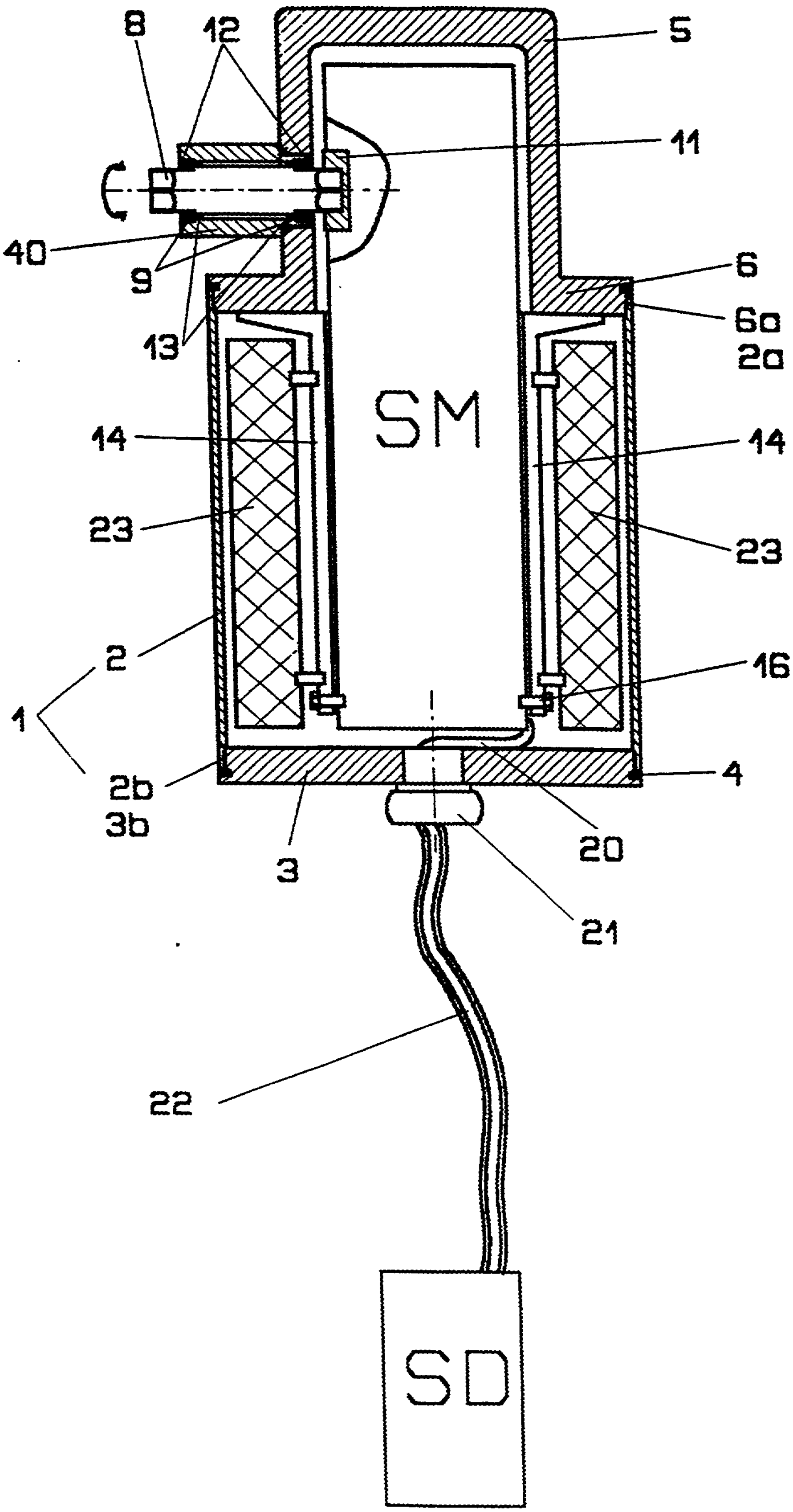

Fig. 1

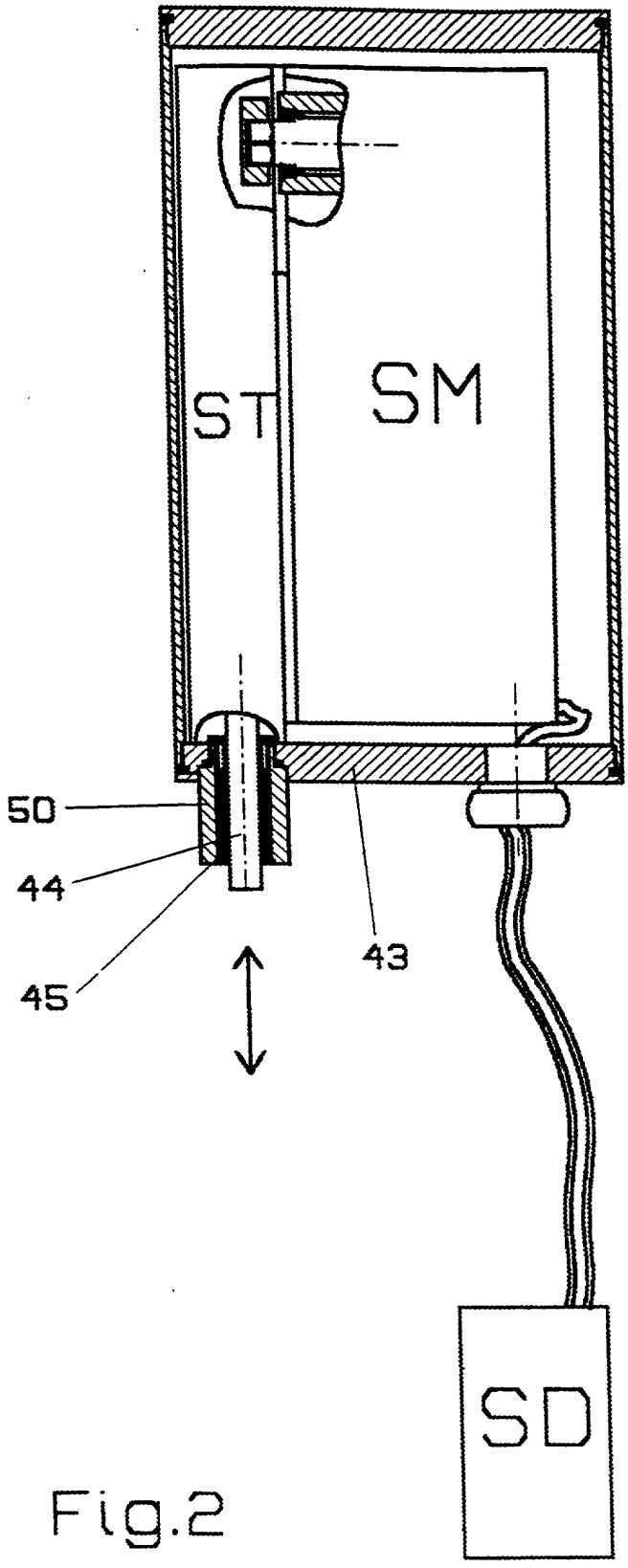

Fig.2

Customer Number 22,852
Attorney Docket No. [Text]

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: Anti-deflagrating operating actuator the specification of which was filed on 27 July 2000 as PCT International Application No. PCT/IT00/00318.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate or § 365(a) of any PCT international application(s) designating at least one country other than the United States, listed below and have also identified below, any foreign application(s) for patent or inventor's certificate, or any PCT International application(s) having a filing date before that of the application(s) of which priority is claimed:

Country	Application Number	Date of Filing	Priority Claimed Under 35 U.S.C. 119
ITALY	TO99A000719	19 August 1999	X YES ☐ NO
[Text]	[Text]	[Datet]	☐ YES ☐ NO

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

Application Number	Date of Filing
[Text]	[Datet]
[Text]	[Datet]

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) or § 365(c) of any PCT International application(s) designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application(s) and the national or PCT International filing date of this application:

Application Number	Date of Filing	Status (Patented, Pending, Abandoned)
[Text]	[Text]	[Text]

I hereby appoint the following attorney and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. **FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P., CUSTOMER NUMBER 22,852**, Douglas B. Henderson, Reg. No. 20,291; Ford F. Farabow, Jr., Reg. No. 20,630; Arthur S. Garrett, Reg. No. 20,338; Donald R. Dunner, Reg. No. 19,073; Brian G. Brunsvold, Reg. No. 22,593; Tipton D. Jennings, IV, Reg. No. 20,645; Jerry D. Voight, Reg. No. 23,020; Laurence R. Hefter, Reg. No. 20,827; Kenneth E. Payne, Reg. No. 23,098; Herbert H. Mintz, Reg. No. 26,691; C. Larry O'Rourke, Reg. No. 26,014; Albert J. Santorelli, Reg. No. 22,610; Michael C. Elmer, Reg. No. 25,857; Richard H. Smith, Reg. No. 20,609; Stephen L. Peterson, Reg. No. 26,325; John M. Romary, Reg. No. 26,331; Bruce C. Zotter, Reg. No. 27,680; Dennis P. O'Reilley, Reg. No. 27,932; Allen M. Sokal, Reg. No. 26,695; Robert D. Bajefsky, Reg. No. 25,387; Richard L. Stroup, Reg. No. 28,478; David W. Hill, Reg. No. 28,220; Thomas L. Irving, Reg. No. 28,619; Charles E. Lipsey, Reg. No. 28,165; Thomas W. Winland, Reg. No. 27,605; Basil J. Lewris, Reg. No. 28,818; Martin I. Fuchs, Reg. No. 28,508; E. Robert Yoches, Reg. No. 30,120; Barry W. Graham, Reg. No. 29,924; Susan Haberman Griffen, Reg. No. 30,907; Richard B. Racine, Reg. No. 30,415; Thomas H. Jenkins, Reg. No. 30,857; Robert E. Converse, Jr., Reg. No. 27,432; Clair X. Mullen, Jr., Reg. No. 20,348; Christopher P. Foley, Reg. No. 31,354; John C. Paul, Reg. No. 30,413; Roger D. Taylor, Reg. No. 28,992; David M. Kelly, Reg. No. 30,953; Kenneth J. Meyers, Reg. No. 25,146; Carol P. Einaudi, Reg. No. 32,220; Walter Y. Boyd, Jr., Reg. No. 31,738; Steven M. Anzalone, Reg. No. 32,095; Jean B. Fordis, Reg. No. 32,984; Barbara C. McCurdy, Reg. No. 32,120; James K. Hammond, Reg. No. 31,964; Richard V. Burgujian, Reg. No. 31,744; J. Michael Jakes, Reg. No. 32,824; Thomas W. Banks, Reg. No. 32,719; Christopher P. Isaac, Reg. No. 32,616; Bryan C. Diner, Reg. No. 32,409; M. Paul Barker, Reg. No. 32,013; Andrew Chanho Sonu, Reg. No. 33,457; David S. Forman, Reg. No. 33,694; Vincent P. Kovalick, Reg. No. 32,867; James W. Edmondson, Reg. No. 33,871; Michael R. McGurk, Reg. No. 32,045; Joann M. Neth, Reg. No. 36,363; Gerson S. Panitch, Reg. No. 33,751; Cheri M. Taylor, Reg. No. 33,216; Charles E. Van Horn, Reg. No. 40,266; Linda A. Wadler, Reg. No. 33,218; Jeffrey A. Berkowitz, Reg. No. 36,743; Michael R. Kelly, Reg. No. 33,921; James B. Monroe, Reg. No. 33,971; Doris Johnson Hines, Reg. No. 34,629; Allen R. Jensen, Reg. No. 28,224; Lori Ann Johnson, Reg. No. 34,498; and David A. Manspeizer, Reg. No. 37,540 and [Text]. Please address all correspondence to **FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.** 1300 I Street, N.W., Washington, D.C. 20005, Telephone No. (202) 408-4000.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Full Name of First Inventor DE MARTINO Bernardino	Inventor's Signature Bernardino De Martino	Date 28 March 2001
Residence Via Pascoli 13 - I-24068 Seriate - Italy		Citizenship Italian
Post Office Address Via Pascoli 13 - I-24068 Seriate - Italy		

Listing of Inventors Continued on Page 2 hereof. ☐ Yes ☐ No